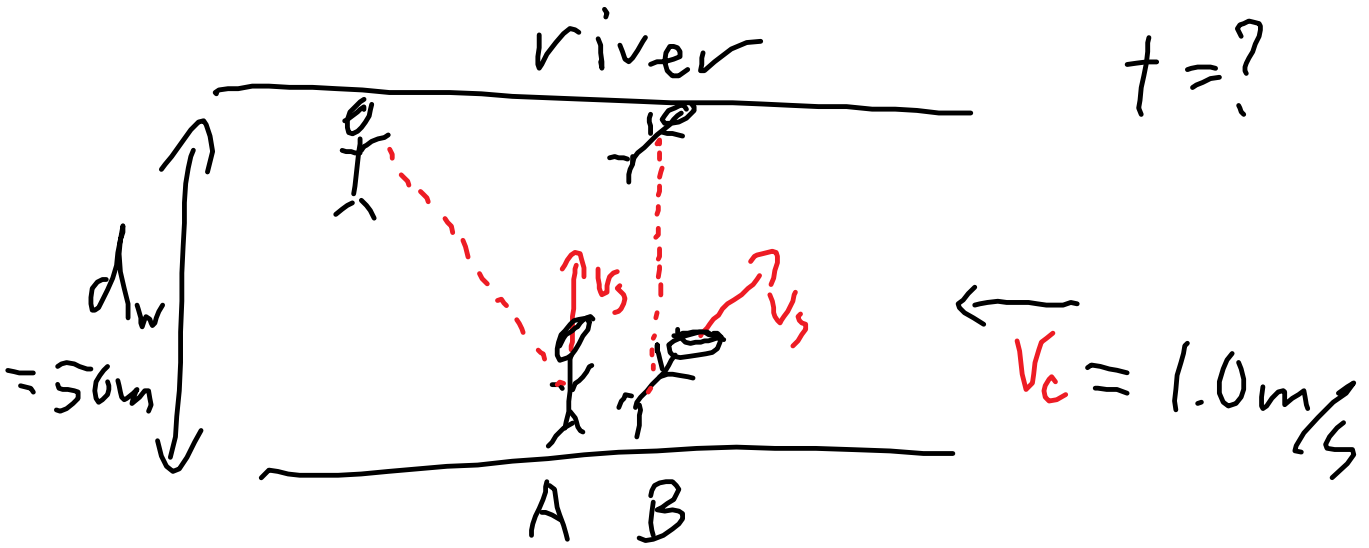
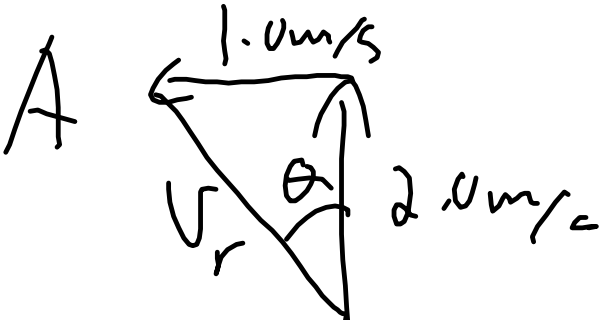
Lab recap
Perpendicular Vectors are Independent
videos: https://www.youtube.com/watch?v=DVU93vLzI1k

If you swim across a river with a strong current, is it faster to direct yourself straight across and let the current push you downstream or should you direct yourself upstream so you go the shorter path, straight across?



$V_s = 2.0 m/s$

1. Calculate total d and v



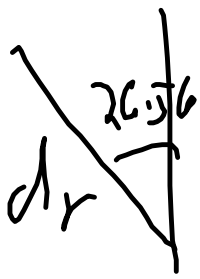
$V_r = \sqrt{1^2 + 2^2}$

$V_r = 2.236 m/s$

$V_r = 2.236 \text{ m/s}$

$\theta = \tan^{-1}\frac{1}{2}$ $\quad \theta = 26.57°$

$\cos 26.57 = \frac{50}{d_r}$



$d_r = \frac{50}{\cos 26.57}$

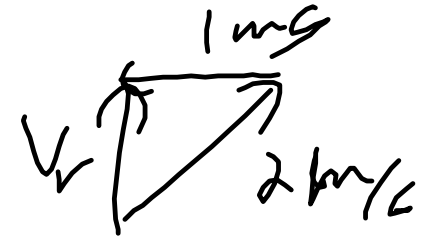
$d_r = 55.90 \text{ m}$

$t = \frac{d_r}{V} = \frac{55.90 \text{ m}}{2.236 \text{ m/s}}$

$\boxed{t = 25.0 \text{ s}}$

or $\quad t = \frac{d_w}{V_s} = \frac{50 \text{ m}}{2.0 \text{ m/s}} = \boxed{25 \text{ s}}$

B



$V_r = \sqrt{4^2 - 1}$

$V_r = \sqrt{3}$

$V_R = 1.732\ m/s$

$t = \frac{50m}{1.732\ m/s} = 28.9\ s$

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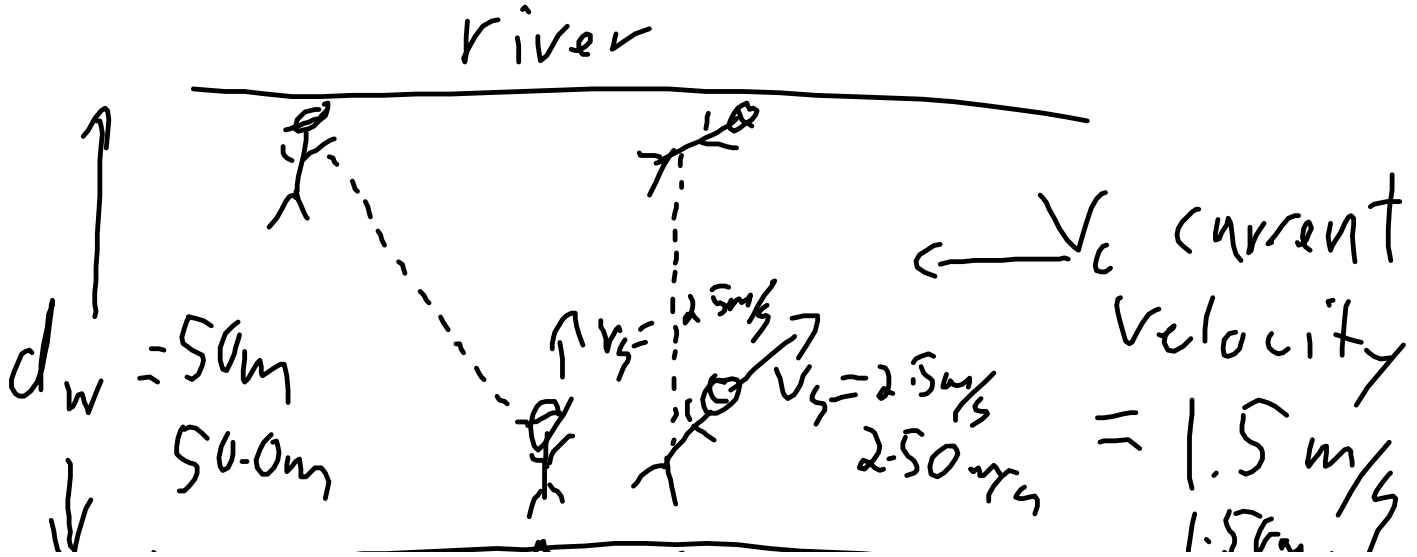
Block 2-3

Perpendicular Vectors are Independent

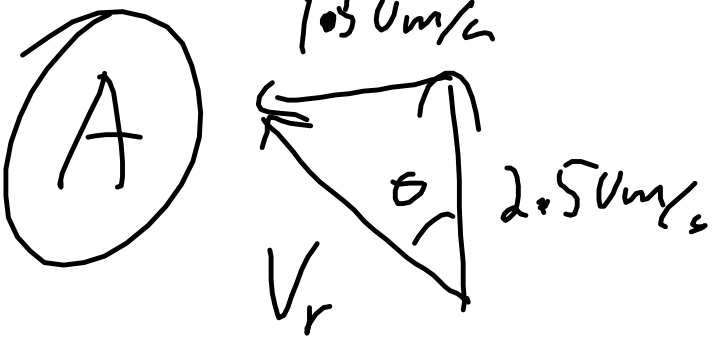
Look at our videos of swimmers crossing a river with a strong current.

Who will cross the river faster,
A) a swimmer pointing straight across and being pushed downstream by the current or
B) a swimmer directing upstream so they swim straight across the river?



V_s is Velocity of swimmer with no current

Method 1 – $\frac{\text{total } d}{\text{resultant } v} = t$

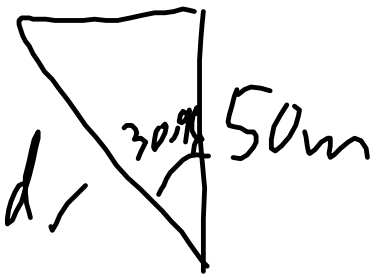


$V_r = \sqrt{1.5^2 + 2.5^2}$

2.915

$V_r = 2.92 \text{ m/s}$

$\theta = \tan^{-1}\frac{1.5}{2.5} = 30.963°$



$\cos 30.963 = \frac{50m}{d_r}$

$d_r = 58.309 m$

$t = \frac{d_r}{V_r} = \frac{58.309 m}{2.915 m/s}$

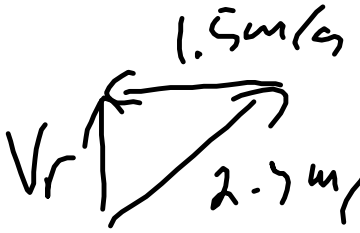
$V_r = 2.9154 \text{ m/s}$

$\boxed{t = 20.0\text{s}}$

Method 2 - look at components across the river.

$t = \frac{dw}{V_s} = \frac{50\text{m}}{2.5\text{m/s}} = \boxed{20.0\text{s}}$

Swimmer B



$V_r = \sqrt{2.5^2 - 1.5^2}$

$V_r = 2.00 \text{ m/s}$

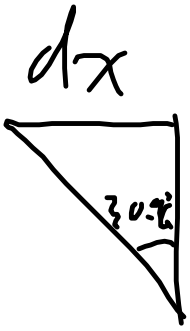
$t = \frac{dw}{V_r} = \frac{50\text{ m}}{2.00\text{ m/s}} = \boxed{25.0\text{s}}$

Swimmer A was faster

D) How far apart are they?

b) How far ... ?,

Method 1 -



$$\tan 30.0^\circ = \frac{dx}{50}$$

$$dx = 30.0\text{m}$$

Method 2 - $d_x = V_x t = 1.5\text{m/s}\,(20\text{s})$

$= 30.0\text{m}$